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(21)

ANNUAL REPORT ON THE FEDERAL-PROVINCIAL AGREEMENTS FOR THE EASTERN CANADA ACID RAIN PROGRAM

1991



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CANADA'S GREEN PLAN

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Please note the following changes in this report:

CAI
EP
-A58 Introduction: The bilateral Canada-United States Air Quality Agreement on Transboundary Air Pollution was actually signed in March, 1991.

-A58 In Table 1 - Note 6, should read: The total of objectives under current federal-provincial agreements is 2349 kilotonnes. Reducing the remaining 49 kilotonnes will be achieved by amending these agreements.

Most of the content of this report is based on information obtained from the provinces' reports for the 1991 calendar year.

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The Eastern Canada Acid Rain Control Program, 1991

Introduction

This report is the third in a series documenting progress in reducing emissions of sulphur dioxide (SO₂) under the Eastern Canada Acid Rain Control Program. The report updates emissions data to the end of 1991 and summarizes recent major program achievements.

The Program was initiated in 1985 and subsequently formalized in seven federal-provincial agreements. These agreements set out specific SO₂ emission reduction targets and timetables for each of the parties. The Program aims, by 1994, to reduce SO₂ emissions in the seven eastern provinces to 2300 kilotonnes. This reduction is 40 percent less than 1980, when 3818 kilotonnes were emitted. For its part in the agreements, the federal government is seeking reductions in transboundary flows of SO₂ from the United States, and supporting research and development projects in SO₂ reduction technologies.

To date, most emission reduction has been sought at the major individual sources, such as non-ferrous metals smelters and fossil-fuelled power plants, which accounted for 80 percent of the SO₂ emissions in eastern Canada in 1980. This approach has resulted in a wide range of province-specific and source-specific emission-reduction measures. The report therefore covers provincial as well as industrial progress.

An important year, 1991 saw much progress under the Eastern Canada Acid Rain Control Program. A major, new, acid-rain program being developed in the United States will reinforce Canadian efforts. Also, the need for joint, coordinated action led in 1990 to the bilateral Canada-United States Air Quality Agreement on Transboundary Air Pollution, which includes Canadian and American program targets as principal elements. As well, 1991 was the first full year of Canada's Green Plan, which builds on the Program's success and sets the future course of action on acid rain after 1994.

The reported emissions reflect the most recent provincial estimates, shown in Figure 1 and summarized in Table 1. These data indicate an SO₂ emissions total of 2447 kilotonnes in 1991, representing a 36 percent reduction from 1980 emissions. Table 2 provides additional SO₂ emissions data from smelters and fossil-fuelled power plants, which are the major individual sources. The substantial progress made in 1991 on several major capital projects to reduce SO₂ emissions, and the completion of new emissions abatement facilities, help to ensure that Canada's Program objectives will be met.

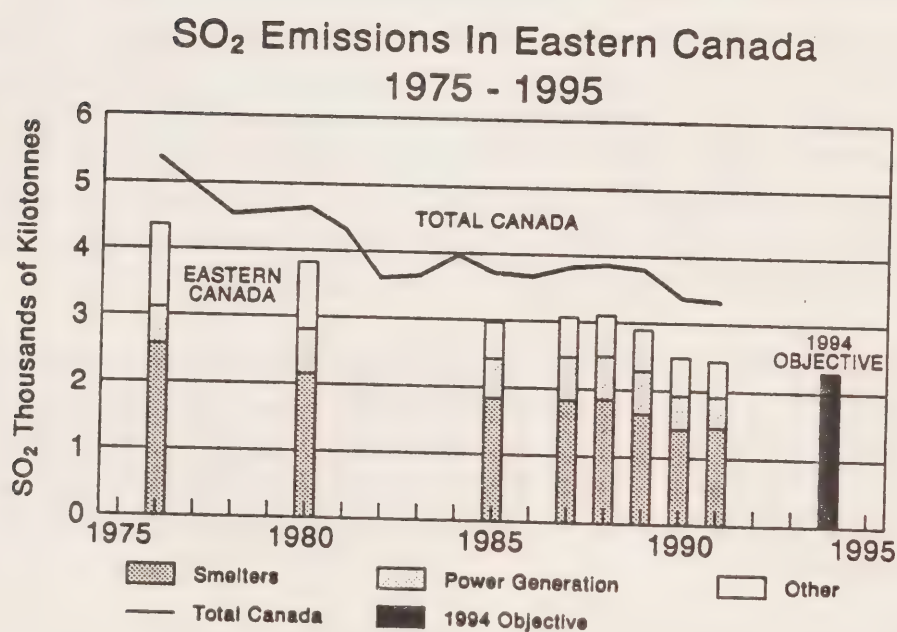


TABLE 1

TOTAL SO₂ EMISSIONS IN EASTERN CANADA, BY PROVINCE,¹ (KILOTONNES)

	1980	1988	1989	1990	1991	1994
	(Actual)					(Emissions limits)
MANITOBA						
Primary metals	463	550	499	500	543	—
Other	21	16	16	16	16	—
Total	484	566	515	516	559	550
ONTARIO						
Primary metals	1096	798	776	730	695	—
Power generation	396	321	305	195	167	—
Other	272	249	252	241	233	—
Total	1764	1368	1333	1166	1095	885
QUEBEC						
Primary metals	641	478	341	189	210	—
Other	457	234	205	202	168	—
Total	1098	712	546	391	378	500 ²
NEW BRUNSWICK						
Primary metals	15	23	23	6	9	—
Power generation	123	158	177	141	130	—
Other	80	29	29	34	33	—
Total	218	210	229	181	172	175 ³
NOVA SCOTIA						
Power generation	125	147	146	143	144	—
Other	68	36	37	35	33	—
Total	193	183	183	178	177	189 ⁴
NEWFOUNDLAND						
Power generation	18	18	26	23	15	—
Other	38	27	23	24	47	—
Total	56	45	49	47	62	45
PRINCE EDWARD ISLAND						
Total⁵	5	3	3	3	4	5
EASTERN CANADA						
Primary metals	2215	1849	1639	1425	1457	—
Power generation	662	644	654	502	456	—
Other	941	594	565	555	534	—
Total	3818	3087	2858	2482	2447	2349 ⁶

Data for 1988, 1989, 1990 and 1991 are taken from the annual reports by the provinces on their SO₂ control programs, as required by the federal-provincial agreements. The emissions levels represent the best estimate available at the time of writing the report. Note that even historical year estimates may be revised as better inventory data are made available.

This revised emission limit reflects amendments to a federal-provincial agreement: from 600 kilotonnes beginning in 1990 to 500 kilotonnes beginning in 1994.

This revised emission limit reflects a renegotiated federal-provincial agreement from the original value of 185 kilotonnes.

This revised emission limit reflects a renegotiated federal-provincial from the original value of 204 kilotonnes.

This value includes a component of power-generation emissions.

The total Eastern Canada Acid Rain Control Program limit is 2300 kilotonnes for 1994. The total of objectives under current federal-provincial agreements is 2484 kilotonnes. Reducing the remaining 164 kilotonnes will be achieved by amending these agreements.

TABLE 2

A) MINERAL EXTRACTION—MAJOR SO₂ SOURCES (KILOTONNES)

	1980	1988	1989	1990	1991	1994
	(Actual)					(Emissions limits)
MANITOBA						
Inco Ltd. (Thompson)	215	284	250	247	250	220
Hudson Bay Mining and Smelting Co. (Flin Flon)	248	266	249	253	293	220
ONTARIO						
Inco Ltd. (Copper Cliff)	812	658	637	617	572	265
Falconbridge (Sudbury)	123	60	68	70	70	100
Algoma (Wawa)	161	80	71	43	53	125
QUEBEC						
Noranda (Horne)	552	425	292	146	165	166
Noranda (Murdochville)	91	58	49	43	45	65
NEW BRUNSWICK						
Noranda (Belledune)	15	23	23	6	8	---

B) ELECTRIC POWER GENERATION—MAJOR SO₂ SOURCES (KILOTONNES)

	1980	1988	1989	1990	1991	1994
	(Actual)					(Emissions limits)
Ontario Hydro	396	321	305	195	167	175
New Brunswick Power	123	158	177	141	130	123
Nova Scotia Power	125	147	146	143	144	145

Provincial and Industrial Action

Manitoba (1994 target: 550 kilotonnes)

Manitoba has two principal sources of SO₂ emissions: the Inco Ltd. smelter in Thompson and the Hudson Bay Mining and Smelting Co. Ltd. (HBMS) smelter in Flin Flon. As part of the Eastern Canada Acid Rain Control Program, both are required to reduce their annual SO₂ emission to below 220 kilotonnes, beginning January 1, 1994. (Other minor sources of emissions typically account for about 3 percent of annual provincial SO₂ emissions.)

PRIMARY METALS

To comply with its SO₂ emission limit, Inco Ltd. has been optimizing its pyrrhotite-rejection process and intends to change its metallurgical process by 1994.

For its part, HBMS Ltd. announced, on December 13, 1991, a new zinc pressure leaching system and a major modification to the copper smelter. These changes will reduce SO₂ emissions by at least 25 percent and also substantially reduce other emissions such as particulates. As well, HBMS will use much less heavy oil and coal at the facility. Together, these improvements will help HBMS to meet its SO₂ limit.

The emissions from these smelters depend on market fluctuations of base metal prices, and vary annually, as shown in tables 1 and 2.

RESEARCH AND MONITORING

As well as moving forward in reducing SO₂ emissions, Manitoba continued to work on other aspects of the acid-rain problem. The province monitored acid precipitation at three sites, surveyed acidity of snow pack, monitored receptors at federal and provincial sites, and continued to study coniferous forest regeneration in soils damaged by smelter emissions.

Ontario (1994 limit: 885 kilotonnes)

In 1985, Ontario announced the Countdown Acid Rain Program, which targeted major stationary SO₂ sources such as smelters and fossil-fuelled power plants. In 1991, the four corporate sources regulated under the Countdown program were in full compliance with their emission limits, summarized in Table 2.

PRIMARY METALS

Inco Ltd. completed a mill rationalization program to provide a concentrate with higher metals content, and commissioned the first flash furnace at the Copper Cliff site. These changes, integrated with the new acid plant, are expected to reduce SO₂ emissions a further 100 kilotonnes in 1992.

Falconbridge at Sudbury announced process changes that it believes could reduce SO₂ emissions a further 25 kilotonnes annually from the 1994 regulatory limit of 100 kilotonnes. The company is confident that this lower emission target can be achieved before 1998.

At the Algoma iron-ore sintering plant in Wawa, a combination of process feed changes and production rationalization will enable the company to keep its annual SO₂ emissions below 80 kilotonnes—well under the 1994 regulatory limit of 125 kilotonnes.

POWER GENERATION

The provincial electric utility, Ontario Hydro, is building two flue-gas desulphurization scrubbers at the existing coal-burning Lambton station. These will capture over 90 percent of SO₂ emissions from half the station. The scrubbers are expected to operate early in 1994. Hydro has also installed flue-gas conditioning equipment at all operating units of the Lambton, Nanticoke and Lakeview coal-burning power plants to allow them to use low-sulphur coal without impeding the performance of the existing particulate emission-control systems.

RESEARCH AND MONITORING

Ontario's scientific program continued to monitor the Countdown program's effectiveness in reducing sulphate deposition levels, and the associated recovery of some aquatic ecosystems. The scientific program also completed a survey of hardwood decline across the province. As well, work under the North American Maple Project continued in 1991, with results indicating that sugar maple conditions improved from 1988 to 1990, and that wet sulphate deposition seems to have had no major effect on sugar maple in the areas sampled. Work also continued on source-receptor modelling using the Atmospheric Deposition and Oxidants Model.

Quebec (1994 limit: 500 kilotonnes)

In Quebec, the Eastern Canada Acid Rain Control Program had 1990 as its target date. Therefore, 1991 was the second full-compliance year of the provincial SO₂ control program. As in 1990, Quebec's SO₂ emissions in 1991 were well below the provincial objective for the 1990-1993 period of 600 kilotonnes, totalling 378 kilotonnes in 1991.

PRIMARY METALS

New facilities at the Noranda Horne smelter performed exceptionally well, limiting emissions to 165 kilotonnes—about half the objective for this facility at the outset of the program. Noranda continues to investigate SO₂ reduction/capture schemes and has announced that it aims to reduce plant emissions to 55 kilotonnes by the end of the decade.

To some extent, slightly increased SO₂ emissions in some industrial sectors were offset by decreases elsewhere, due to slow economic conditions. In some cases, permanent plant closures will eliminate emissions from outdated equipment or processes.

POWER GENERATION

The only major fossil-fuelled power plant in the province is the 600-megawatt Tracy oil-burning facility. This plant is being evaluated for a major rehabilitation program and was not much used in 1991. The annual emissions limit for Tracy was set in 1990 at 18 kilotonnes and its 1991 emissions totalled 11 kilotonnes.

RESEARCH AND MONITORING

Quebec continued its research and monitoring efforts, including its part of the North American Maple Project, and detailed studies of fish populations in acid-sensitive lakes.

In 1991, Quebec sampled 64 lakes in the Rouyn-Noranda region that were previously sampled in 1982 to detect any improvement in water quality due to reduced acid deposition. The data reveal reduced sulphate in lake waters, particularly close to the Noranda Smelter.

At the end of 1991, Quebec had widened its precipitation and air pollution sampling network to 56 sites. In the decade to 1991, samples from these sites revealed that although wet sulphate deposition has declined by 20 percent in the Abitibi region (close to the Noranda Smelter), unfortunately, in the southern part of the province,

little reduction has been observed. Continuing vigilance will be required to verify progress in emission-control programs in Canada and the United States.

New Brunswick (1994 target: 175 kilotonnes)

In New Brunswick, burning fossil fuel to produce electricity accounts for nearly 75 percent of total SO₂ emissions. Other major sources include pulp and paper mills, the Noranda Brunswick Smelter at Belledune and the Irving Oil refinery at Saint John.

POWER GENERATION

New Brunswick Power, the province's electric utility, is heavily interconnected with neighbouring systems in Canada and the United States and is called upon to assist other utilities facing shortages or unplanned outages. As documented in tables 1 and 2, this buying and selling of power results in substantial annual fluctuations in the demand for New Brunswick Power electricity and hence SO₂ emissions.

New Brunswick has developed a comprehensive policy on SO₂ emitted by the electric power sector and established an annual emissions ceiling of 123 kilotonnes for New Brunswick Power.

New Brunswick Power initially minimized its fossil-fuel generation by using its nuclear capacity and buying electricity from neighbouring utilities. It is now building a 450-megawatt coal-burning power plant at Belledune, equipped with a wet limestone scrubber. The power plant is expected to be in service in November 1993. As well, an existing 312-megawatt coal and oil-burning power plant, Dalhousie, is being converted to burn a water-bitumen mixture, Orimulsion, and will be retrofitted with a wet limestone flue-gas scrubber. This project will likely come into service in November 1994. Other SO₂ control measures include using 1-percent-sulphur fuel oil at the Courtenay Bay generating station, and implementing conservation and demand management programs. These developments will ensure that New Brunswick Power will meet commitments to its customers while complying with the provincial SO₂ limits.

PULP AND PAPER

In 1990, pulp and paper mills in New Brunswick completed modernization programs designed to bring them into compliance with provincial regulations. This sector is expected to maintain SO₂ emissions levels below 20 kilotonnes per year.

PRIMARY METALS

The Brunswick metals smelter in Belldune captures more than 80 percent of its SO₂ emissions. In addition, recently upgraded equipment and operating procedures to cope with local air quality conditions have reduced the last two years' emissions.

OIL

The Irving Oil refinery at Saint John, the largest refinery in North America, continues to operate at a high throughput and maintains its emissions well below the annual provincial limit of 8 kilotonnes.

RESEARCH AND MONITORING

New Brunswick has been actively monitoring acid deposition since the early 1980s and has expanded its coverage to include some 20 stations. Of great interest, this work indicates deposition patterns that contrast substantially with the regional or national ones previously published by numerous sources. Specifically, New Brunswick has monitored 25 to 30 kilograms of SO₂ per hectare per year along the southern coast, with a rapidly declining gradient to the north. Levels of about 10 to 14 kilograms of SO₂ per hectare per year occur across the northern half of the province. These findings agree with predictions made by the Federal-Provincial Research and Monitoring Coordinating Committee, the National Acid Precipitation Assessment Program and the Royal Society of Canada that the sensitive ecosystems of southern New Brunswick are still at risk despite current emission-reduction commitments.

Nova Scotia (1994 target: 189 kilotonnes)

Nova Scotia Power accounts for approximately 80 percent of the province's SO₂ emissions. Other major sources include petroleum refining and the pulp and paper industry.

POWER GENERATION

The province established an initial annual SO₂ emissions target for Nova Scotia Power of 160 kilotonnes, and the utility subsequently agreed to a reduced target of 145 kilotonnes. In 1991, Nova Scotia Power's SO₂ emissions were below this target. In the revised agreement covering the period 1994 to the year 2000 the utility's target is still 145 kilotonnes. The utility has since embarked on a long-range program to cut annual SO₂ emissions to less than 90 kilotonnes by the year 2010. The program will: complete the world's largest, circulating fluidized-bed combustor at Point Aconi, designed to achieve 90 percent SO₂ removal; expand the

use of low-sulphur coal and oil at existing power plants; expand demand management; and test and demonstrate emission-control technologies. The other major industrial sources are not expected to increase their emissions substantially.

RESEARCH AND MONITORING

Nova Scotia continued to monitor acid deposition at two sites. Data collected at these sites and at sites operated by Environment Canada indicate a slight decrease in overall acid deposition in the province; however, deposition levels continue to be higher than those needed to protect sensitive aquatic ecosystems.

Newfoundland (1994 target: 45 kilotonnes)

In Newfoundland, two major sources account for most of the province's emissions of SO₂: the 500-megawatt, heavy-oil burning, Holyrood power plant and the Come-by-Chance oil refinery.

POWER GENERATION

In 1991, the province and its electric utility, Newfoundland and Labrador Hydro, agreed to limit annual SO₂ emissions to 25 kilotonnes. However, since only this facility provides the island with non-hydro electricity, the limitation applies to years with normal or above-normal rainfall. Emission reductions may be achieved by using low-sulphur fuels. In 1991, Holyrood's SO₂ emissions totalled only 15 kilotonnes.

OIL

The Come-by-Chance oil refinery has been refining crudes higher in sulphur than in previous years. As a result, sulphur oxide emissions have increased from previous levels. The province is working with the refinery to ensure that provincial air-quality standards are met, and to reduce SO₂ emissions to the 45-kilotonne provincial emissions target.

Prince Edward Island (1994 objective: 5 kilotonnes)

Virtually all of Prince Edward Island's SO₂ emissions are from fossil-fuel combustion, much of it at the 71-megawatt Charlottetown power plant. Since most of the electricity used in the province comes from New Brunswick via underwater cable, the Island capacity is not used extensively. Energy conservation programs and programs to encourage the use of biomass fuel have further reduced the need for

sulphur-bearing fossil fuels. The province therefore expects its emissions to continue to be below the 5-kilotonne objective.

Acid Rain Program Highlights for 1991

The previous section summarized provincial and industrial actions to reduce SO₂ emissions and monitor progress. In addition to these actions, several federal government departments and the provinces have collaborated on applying new emission-control technologies, conducting scientific research and monitoring ecosystems. The need to reduce acidic pollutant inflows, particularly from major source areas in the United States, has also led to international and bilateral initiatives by the Government of Canada.

The first year of the Canada-United States Air Quality Agreement on Air Quality was 1991. This agreement formalized both countries' obligations to implement domestic acid-gas control measures, to address transboundary issues and to cooperate in a wide range of technical and scientific areas. In 1990, the United States proposed amending its *Clean Air Act* to include major new provisions that will roughly halve its power-plant SO₂ emissions by the year 2000. In 1991, the United States elaborated, in detailed regulatory and program form, on how this commitment would be met. The proposed regulations specify emissions limitations at over 100 existing power plants, and an innovative emissions-trading scheme. A detailed public review of these proposals was undertaken and the finalization of regulations is expected in 1992.

Other 1991 highlights of Canadian activities:

- In November 1991 in Montréal, Environment Canada, the Ministry of Environment of Quebec, the Air and Waste Management Association and the *Ordre des ingénieurs du Québec* co-sponsored a two-day symposium on acid precipitation and ozone smog in Quebec.
- Quebec hosted a conference in Montréal on acid-rain research. Conference findings projected that, by 2003, 77 percent of acid lakes in Quebec will see their pH levels improve to over 5.5, and fully 50 percent are expected to return to a non-acid state (pH greater than 6). Quebec researchers published a number of scientific papers and reports on acid-rain effects on water quality, aquatic life and forests.

- Environment Canada released a major report and database on lake-water quality in Quebec and on data gathered throughout the 1980s at the Lac Laflamme calibrated watershed.
- Environment Canada, Forestry Canada and the University of New Brunswick continued their work developing and applying a biophysical model to assess and quantify the long-term effect of acidic deposition on forests and forest productivity.
- In response to increasing concern over the possible role of nitrogen oxides in Canadian acid rain, Environment Canada initiated an assessment of existing data on surface water chemistry to define the real and potential effect of nitrogen deposition in southeastern Canada. This work may identify the need for further research and monitoring.
- The Canadian Electrical Association, the national association of electric utilities, continued its program of research, development and demonstration of technologies to reduce SO₂ and nitrogen oxide emissions at power plants. Much of this work was conducted in collaboration with federal-provincial government agencies, including contributions from Energy, Mines and Resources Canada and Environment Canada. The association is reviewing sorbent-injection processes, researching low-temperature catalysts for nitrogen oxide control, and improving desulphurization processes, to minimize associated wastewater and waste-disposal problems.
- Continuing sampling and monitoring at a network of 157 lakes and 27 rivers indicates that sulphate levels at many sites are declining. This has yet to translate into measurable water quality improvements at many sites.
- The Atmospheric Environment Service of Environment Canada operates a nation-wide acid-rain monitoring network (CAPMON). This network has detected decreases in the concentrations of sulphate in precipitation since the early 1980s. For example, at Kejimikujik National Park in southwestern Nova Scotia, average sulphate levels recorded from 1989 to 1991 were about 20 percent less than from 1980 to 1982.
- A major eight-volume acid-rain assessment report on the state of science and technology was released by Environment Canada early in 1991. It reviews more than a decade of research on acid rain and air pollution in Canada and

examines progress made in reducing SO₂ emissions. The report concludes that the control programs in Canada and the United States will result in major improvements, but stresses that continuing efforts and vigilance will be needed throughout the 1990s to ensure that controls are implemented and to verify that the environment is recovering.

- Canada continued to play an important role in reviewing the international United Nations protocols on SO₂ and nitrogen oxides.

Conclusion

This year, 1991, was an important one for the Eastern Canada Acid Rain Control Program. It marked the passing of the first full decade of work with a major assessment report. It also saw the development of new regulatory initiatives in the United States and the implementation of a bilateral agreement to cooperate on solving the North American acid-rain problem. Scientific research continued and revealed the first signs of recovery, reinforcing support for continued action and watchfulness. Research and development by governments and industries is now resulting in the successful application of advanced technologies for acid-gas controls. These measures ensure that Canada's Program objectives will be met. The course is set for the rest of the 1990s.



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The Eastern Canada Acid Rain Control Program, 1992

Introduction

This is the fourth report on the implementation of the Eastern Canada Acid Rain Control Program. The program will cut sulphur dioxide (SO₂) emissions in the seven eastern provinces to below 2.3 million tonnes in 1994, from 3.8 million tonnes emitted in 1980. The report includes emissions data to the end of 1992 and highlights significant milestones and achievements.

The Canadian Program was initiated in 1985 and subsequently formalized in seven federal-provincial agreements. These set out specific SO₂ emission reduction targets and timetables for each of the parties. Participating provinces have agreed to cut their aggregate SO₂ emissions by 40 percent from 1980 levels for 1994, to participate in acid rain effects research, to monitor ecosystems and to report on progress. For its part, the federal government has undertaken to seek reductions in transboundary flows of SO₂ from the United States, to conduct a wide array of research activities, to monitor and model deposition, to support research and development projects for SO₂ reduction technologies, and to reduce emissions from federal facilities.

To date, SO₂ emissions reductions have been achieved at large point sources such as non-ferrous metals smelters and fossil fuelled power plants which accounted for 80 percent of the SO₂ emissions in eastern Canada in 1980. The result has been a wide range of province-specific and source-specific emission reduction measures.

Major emission reduction program elements came into place in 1992. The largest point sources of SO₂ were building or completing emission controls such as power plant scrubbers and smelter acid production facilities; federal and provincial governments negotiated to reaffirm and extend acid rain agreements; and the United States put its program into final regulatory form. Governments continued to support research into acid rain and related environmental effects, into new control technologies and to investigate alternative emission management options such as emissions trading.

The reported emissions, reflecting the most recent provincial estimates, are shown in Table 1. Total eastern Canadian SO₂ emissions were 2,316 kilotonnes in 1992, representing nearly a 40 percent reduction from actual 1980 emissions, and very close to the 1994 program target of 2,300 kilotonnes. Nationally, emissions were slightly below the 3,200 kilotonnes national cap.

Table 2 provides additional SO₂ emissions data from the major sources such as smelters and electric utilities.

TOTAL SO₂ EMISSIONS BY PROVINCES (KILOTONNES)

	1980	1989	1990	1991	1992	1994
	(Actual)					(Emissions limits) ⁴
MANITOBA						
Primary Metals	463	499	500	543	555	—
Other	21	16	16	16	10	—
Total	484	515	516	559	565	550
ONTARIO						
Primary Metals	1096	776	730	695	506	—
Power Generation	396	305	195	167	157	—
Other	272	252	241	233	239	—
Total	1764	1333	1166	1095	902	885
QUEBEC						
Primary Metals	641	341	189	210	218	—
Other	457	205	202	168	182	500
Total	1098	546	391	378	400	—
NEW BRUNSWICK						
Primary Metals	15	23	6	9	12	—
Power Generation	123	177	141	130	149	—
Other	80	29	34	33	32	—
Total	218	229	181	172	193	175
NOVA SCOTIA						
Power Generation	125	146	143	144	143	—
Other	68	37	35	33	34	—
Total	193	183	178	177	177	189
NEWFOUNDLAND						
Power Generation	18	25	21	14	18	—
Other	38	28	36	48	57	—
Total	56	53	57	62	75	45
PRINCE EDWARD ISLAND						
Total ³	5	3	3	4	4	5
EASTERN CANADA TOTAL						
Primary Metals	2215	1639	1425	1457	1291	—
Power Generation	662	653	500	455	467	—
Other	941	570	567	535	558	—
Total ²	3818	2862	2492	2447	2316	2349 ²

Data for 1989 to 1992 are taken from annual reports by the provinces on their SO₂ control programs. The emissions levels represent the best estimate available at the time of writing the report. Note that even historic year estimates may be revised as better inventory data is made available.

The 1994 Eastern Canada Program target is 2300 kilotonnes. The total of provincial objectives is currently being renegotiated from 2349 kilotonnes to 2300 Kilotonnes. Renegotiated federal-provincial agreements are in place with Quebec, New Brunswick and Nova Scotia.

This value includes a component of power generation emissions.

The revised emission limit reflects a renegotiated federal-provincial agreement.

TABLE: 2

MINERAL EXTRACTION AND SMELTING: MAJOR SO₂ SOURCES (KILOTONNES)

	1980	1989	1990	1991	1992	1994
	(Actual)					(Emissions limits)
MANITOBA						
INCO (THOMPSON)	215	250	247	250	267	220
HBMS (FLIN FLON)	248	249	253	293	288	220
ONTARIO						
INCO (Copper Cliff)	812	637	617	572	416	265
FALCONBRIDGE (Sudbury)	123	68	70	70	54	100
ALGOMA (Wawa, Iron Ore)	161	71	43	53	36	125
QUEBEC						
NORANDA (Horne)	552	292	146	165	168	272
NORANDA (Murdochville)	91	49	43	45	50	65
NEW BRUNSWICK						
NORANDA (Belledune)	15	23	6	9	12	---

ELECTRIC POWER GENERATION: MAJOR SO₂ SOURCES

	1980	1989	1990	1991	1992	1994
	(Actual)					(Emissions limits)
ONTARIO HYDRO	396	305	195	167	157	175
NEW BRUNSWICK	123	177	141	130	149	123
NOVA SCOTIA POWER	125	146	143	144	143	145

Provincial and Industrial Action

Manitoba (1994 target 550 kilotonnes)

Manitoba has two main sources of SO₂, accounting for about 98 percent of total provincial SO₂ emissions. These are the INCO Limited smelter at Thompson and the Hudson Bay Mining and Smelting Limited (HBMS) smelter at Flin Flon. Manitoba regulations require that, after January 1, 1994, each smelter not emit more than 220 kilotonnes of SO₂ annually.

Both sources are taking measures to ensure their compliance with the regulations. INCO has been optimising its processes to reject sulphur-bearing ore fraction (pyrrhotite rejection) and will be modifying the metallurgical process to reduce SO₂ production. HBMS is installing a new zinc pressure-leaching system, and evaluating major changes to the copper smelter. As shown in Table 1, SO₂ emissions in 1992 were slightly higher than in 1991 reflecting normal fluctuations in metals production. Other sources, mainly fuel oil use, accounted for most of the province's remaining 10 kilotonnes of emissions.

Manitoba was also active in other acid rain work, including daily precipitation monitoring at three sites, a 22-station snowpack survey and vegetation studies in acid and metals-contaminated soils associated with the smelters.

Ontario (1994 limit 885 kilotonnes)

In 1992, Ontario's major stationary SO₂ sources continued to work towards complying with the regulatory limits imposed on them by the province under its SO₂ Control Program (see Table 2). Since 1990, Ontario has had an emissions verification program for four major emitters which requires an annual SO₂ emissions audit by independent consultants.

INCO Ltd.'s emissions were 156 kilotonnes less than in 1991 due to process changes already in place at the Sudbury operations. The current research and development plan, filed with the province, showed that the company is working on new technologies to further reduce its emissions. The current construction schedule indicated that work will be completed in time to ensure that SO₂ emissions from the plant are below the 265 kilotonne 1994 regulatory limit.

Falconbridge Ltd. continues to emit SO₂ at levels substantially below its 100 kilotonne 1994 regulatory limit, in fact 65 percent less in 1992. The company had reaffirmed its plan to respect its 1994 SO₂ limit of 100 kilotonnes and is implementing operational changes to ensure this. In 1992, the No. 2 fluid bed roaster hearth was enlarged to permit higher sulphur removal rates. As well, tests continued on using lower sulphur calcine in the electric furnace and on increasing sulphur rejection in mineral beneficiation.

At 36 kilotonnes, Algoma Steel Inc.'s 1992 SO₂ emissions for the Wawa sintering plant were again well below its 1994 limit of 125 kilotonnes largely because of production down-sizing. The company plans to use lower sulphur feedstocks in future and expects that emissions will remain below 60 kilotonnes even at full production.

Ontario Hydro is implementing measures to ensure that its SO₂ emissions are below its 175 kilotonne regulatory limit for 1994. 1992 SO₂ emissions were well below the limit due to reduced demand for electricity, the use of low sulphur coal, better than average hydroelectric production and increased electricity purchases. Hydro is building wet scrubbers to capture SO₂ at two units of the Lambton coal-fired plant and has expanded use of low sulphur coal as a means to ensure continuing compliance with provincial regulations.

In Ontario, acid deposition monitoring is conducted under the Acidic Precipitation in Ontario Study (APIOS), using two networks which have been in operation since 1981. In 1992, an extensive redesign of the program was undertaken to reduce costs while maintaining the minimum viable network adequate to define spatial and temporal trends in acidic deposition. The final design, implemented in April and May 1992, allows for 17 cumulative 28-day sampling sites throughout the province with one daily site at Dorset, near Algonquin Park. This network will be maintained for the foreseeable future to monitor the effectiveness of the Canadian and United States SO₂ control programs.

Quebec (1994 objective 500 kilotonnes)

In 1992, Quebec SO₂ emissions totalled 400 kilotonnes, up slightly from 1991 levels but fully 200 kilotonnes below the province's original program target and well below the recently renegotiated provincial annual limit of 500 kilotonnes. The small increase is attributable to emissions from two new aluminium smelters and increased production at the province's copper smelters. Tables 1 and 2 outline the emissions trends for the major source sectors:

- Copper smelting: SO₂ emissions at the Noranda Metals Horne smelter increased by about 8 kilotonnes in 1992 due to higher production levels. However, this level is still 70 percent below 1980 levels and the company has announced its intention to further reduce annual emissions to about 55 kilotonnes by the end of the decade. This will represent a 90 percent drop from pre-control levels. The province's other copper smelter in Murdochville also emitted somewhat more SO₂ in 1992 than in 1991 also due to higher metals production. The facility is still operating well within its permitted limit.
- Aluminium smelting: emissions increased by about 7 kilotonnes in 1992 mainly because of increased production at two new smelters, Lauralco and Allouette. This increase now makes aluminium smelting the second highest SO₂ emissions source-sector in Quebec.
- Pulp and paper, and petroleum refining: aggregate emissions have declined relative to 1991 levels. This is partly as a result of reduced economic activity, but also due to restructuring and permanent closure of older, less efficient facilities.
- Electric power sector: a return to more normal precipitation levels has largely eliminated the need for fossil fuel-based production and the associated SO₂ emissions.

In 1992, Quebec continued its broad-based program of acid rain research and monitoring. Six reports and research papers were written on acid deposition aquatic impacts. These document the results obtained from the Quebec lake survey and show that nearly 20 percent or 29,000 of the 160,000 northern shield lakes were acid between 1986 and 1990. While lakes in northern and eastern Quebec are naturally acidic, lakes in the southwest of the province are acid because of man-made pollutants.

Modeling of the Canadian and United States SO₂ control programs indicates that, by 2003, a modest improvement in lake alkalinity and pH is expected for those lakes west of the Saguenay River.

New Brunswick (1994 target 175 kilotonnes)

New Brunswick signed a renewed SO₂ reduction program agreement in March, 1992. This agreement reduces the province's annual emissions limit from 185 to 175 kilotonnes and extends the agreement date to the year 2000. The province has also negotiated further emission reductions from pulp mills and New Brunswick Power.

As shown in Table 1, the province's SO₂ emissions increased by about 21 kilotonnes from 1991, due to increased production at utility power plants. Despite this short-term increase, specific measures are now being implemented at major sources to ensure that the provincial objective will be met.

New Brunswick Power is the largest SO₂ emitter in the province. It operates four major fuel-burning plants and is constructing a 450 Megawatt coal-burning plant at Belledune which will be equipped with a wet limestone SO₂ scrubber. A similar scrubber is also being installed at the 300 Megawatt oil-burning Dalhousie plant as part of a conversion to ORIMULSION™ fuel. Other SO₂ control measures include provision of low sulphur fuel at the Courtenay Bay plant, implementation of conservation and demand management programs and installation of continuous emissions monitoring systems.

Pulp mills were modernized during the 1980's, cutting emissions permanently and ensuring that their SO₂ releases remain below 20 kilotonnes per year. One mill ceased operation in 1992 though the associated steam and power plant continued in use.

The Brunswick Mining and Smelting facility captures over 80 percent of its SO₂ and converts it to acid. Other changes have been made to the plant and more are planned to ensure that ambient air quality limits are consistently met. In 1992, the smelter returned to full operation after two years of reduced production.

New Brunswick operates an extensive acid deposition network in cooperation with NB Power, and Environment Canada. In 1992, existing monitoring sites, monitoring techniques, and siting criteria were reexamined and improved. A much

clearer understanding of wet deposition patterns and levels is now being gained through better monitoring and modelling. Work by New Brunswick and others supports the conclusion that much of the province is very acid-sensitive and that wet sulphate deposition will need to be substantially reduced from current levels if sensitive ecosystems are to be protected.

Nova Scotia (1994 target 189 kilotonnes)

The major source-sector in the province, accounting for 81 percent of 1992 SO₂ emissions in the province is the investor-owned electric utility, Nova Scotia Power Corporation. The company continued its program to limit its annual SO₂ emissions not to exceed 145 kilotonnes after 1994. The utility has also publicly stated its corporate objective of further reducing emissions to about 90 kilotonnes annually, after the year 2000. Nova Scotia Power is completing, in 1993, the world's largest circulating fluidized-bed coal burning power plant (165 MW) at Point Aconi. The plant is designed to capture 90 percent of the sulphur in the fuel and simultaneously reduce nitrogen oxide emissions.

Newfoundland (1994 target 45 kilotonnes)

Newfoundland's major sources of SO₂ are the oil-fired Holyrood electricity generating station and the Come-By-Chance oil refinery. SO₂ emissions from Holyrood are quite variable from year to year because the station supplies energy whenever hydroelectric sources cannot meet demand. Emissions are therefore dependant on precipitation. The province is working with the utility to encourage conservation and to investigate the use of lower sulphur fuel to limit emissions.

The oil refinery's SO₂ emissions have greatly increased in the last five years, largely accounting for the province's emission increase. The sulphur recovery system at the refinery has not been functioning reliably and high-sulphur crude oils are being processed. The province is working with the refinery to resolve these problems and to ensure that the refinery complies with provincial requirements. The consumption of heavy fuel oil by other industries in Newfoundland, notably pulp and paper and fisheries, has fallen due to reduced economic activity.

Prince Edward Island (1994 objective 5 kilotonnes)

Virtually all of Prince Edward Island's SO₂ emissions result from the combustion of fossil fuels. Emissions from all sectors of activity totalled 3.6 kilotonnes in 1992. Industrial and commercial fuel use accounted for 50 percent, power generation 20 percent, and the balance came from the residential and transportation sectors.

Emissions of SO₂ from electrical power generation fluctuate due to the variability of economy energy purchases from New Brunswick, and the resulting need to supplement these purchases with on-island generation. In 1992, electrical generation within the province dropped by 50 percent to 35 GWh. This resulted in a 640 tonne drop in emissions even though overall electricity consumption increased by 1.5 percent to 697 GWh. Maritime Electric, the province's major electrical utility, expects to be able to continue to purchase large quantities of economy energy from New Brunswick Power and, as a result, the company forecasts that, barring unusual conditions or unforeseen circumstances, its emissions will be limited to 840 tonnes per year during the period between 1995 and the year 2000.

The use of biomass fuels at industrial and commercial facilities, and energy conservation programs, will allow the province to maintain its emissions below the 5 kilotonne target in the short-term. The recent introduction of Air Quality Regulations will allow SO₂ emissions to be monitored more closely in the future.

Acid Rain Program Highlights for 1992

The previous sections summarized provincial and industrial actions taken under the acid rain program. As well, federal and provincial government agencies continued to support development and use of new industrial processes and emissions control technologies, promote energy conservation, conduct scientific research, and monitor ecosystems. In consultation with provincial government agencies, industries and other stakeholders, Environment Canada sponsored a first-step evaluation of economic instruments such as emissions trading. These new options hold the promise of achieving environmental goals at minimum cost.

Canada is actively involved with the United States to ensure it meets the requirements set out in the Canada-United States Air Quality Agreement. Environment Canada established a project to monitor the United States progress in implementing their acid rain program and to report on the results obtained under the SO₂ allowance trading program. Canada also continued to work towards a second United Nations Economic Commission for Europe SO₂ Protocol (which was completed and signed June, 1994).

Highlights for 1992 include:

- In March, New Brunswick was the first of the eastern provinces to conclude a renegotiated acid rain agreement with the federal government. Quebec and Nova Scotia signed similar new agreements in 1993, with Quebec reducing its target by 100 kilotonnes to 500 kilotonnes.
- The United States Environmental Protection Agency issued draft regulations to implement their acid rain control program, which is designed to reduce power plant SO₂ emissions by about 10 million tonnes in the next ten years. The proposals also contain a complex emissions trading scheme.
- Environment Canada, Forestry Canada, the Department of Fisheries and Oceans, and Health Canada, in cooperation with United States government agencies, wrote the first bi-annual progress report of the Canada-United States Air Quality Agreement. The report received critical review by the International Joint Commission and was widely distributed in North America in early 1993.
- Environment Canada sponsored two seminars on the US program to prevent significant deterioration in air quality, a major concern in that country. The objectives of the seminars were to familiarize governments and industries with the US program, and to begin discussions on a possible Canadian response.
- Environment Canada sponsored a course on continuous emissions monitoring (CEM). Canada is committed to monitoring power plant emissions using methods of comparable effectiveness to CEM by 1995. The course was well attended by industry and government personnel. Associated with this issue, Canada released its draft Protocols and Specifications for Continuous Emissions Monitoring of Gaseous Emissions from Thermal Power Generation. This document, developed through a multistakeholder process, specifies the design, installation, and operation of automated CEM systems for use at Canadian power plants.

- INCO Ltd. continued a massive modernization program at its Sudbury, Ontario smelter. In 1992, technical problems with the new flash furnace were overcome. Construction of a new flash smelting furnace was also begun. About 89 percent of the \$540 million budgeted for the modernization and SO₂ control program had been expended by the end of 1992.
- While SO₂ emissions are being reduced in North America, nitrogen oxides emissions are remaining fairly constant. There is a serious concern that nitrogen-based acidification in future might erode the benefits obtained by reducing SO₂ emissions. A scientific workshop on nitrogen acidification held at Canada's National Water Research Institute, concluded that the potential for this to occur is significant and led to the undertaking of a quantitative assessment of the current situation.
- Laboratory and field experiments conducted by Forestry Canada demonstrated a linkage between air pollution, exposure to acid deposition, exposure to ozone smog, and damage to the waxy protective coating of tree leaves and needles. This is believed to pre-dispose trees to increased damage from other stresses, such as disease and weather extremes.
- The recent SO₂ emission reductions, exceeding 60 percent, at the Noranda metals smelter in Quebec have resulted in a halving of sulphate concentration in nearby lakes. Although there are as yet no apparent changes in lake acidity, some indicators of water chemistry point towards a possible improving trend in lake water alkalinity.
- In October, Ontario held a workshop to present and review a revised acid deposition monitoring network design, and to discuss objective methods for network design. This was sponsored by the Canadian Institute for Research in Atmospheric Chemistry which published the proceedings.
- Trends data for lakes around Sudbury, Ontario, provided evidence of biological recovery after the local smelters reduced their emissions of SO₂ and trace metals during the 1970s and 1980s. For example, lake trout resumed reproduction when pH increased to 5.6. These studies suggest that many biological populations will recover or can be re-established relatively rapidly (in less than a decade) when acidification is reversed.
- About one-third of Canadian lakes and streams monitored for acid precipitation are recovering, particularly in Nova Scotia and Newfoundland.

- Over the last decade, at the Lac Laflamme calibrated watershed, north of Quebec city, wet sulphate deposition has declined by 26 percent while nitrate deposition has increased by 26 percent. This has resulted in a 12 percent drop in lake water sulphate content between 1986 and 1992 and almost a doubling of the nitrate concentration. In the decade to 1992, Lac Laflamme has lost about 15 percent of its alkalinity, indicating that overall deposition is still too high.
- Within Quebec's 59 lake monitoring network there was a significant reduction in sulphate concentration (from 8 to 33 percent) in 82 percent of sampled lakes. While this is encouraging, 42 percent of these lakes still exhibit a pH below 6.
- Initiated measurements of acid aerosols at sites in eastern Canada to determine regional exposure levels and assess their impact on human health.
- Environment Canada analyzed historical visibility observations from Canadian airports to describe visibility differences across Canada.

Conclusion

The Canadian acid rain program reached an important milestone in 1992, with emissions in eastern Canada substantially meeting the 2.3 million tonne cap, two years ahead of schedule.

Most of the remedial measures are either operating, under construction, or being implemented. Emissions have declined and the first tentative signs of environmental recovery have been detected. The United States is also implementing an aggressive acid gas emissions controls program.

Although the program goals are now being met, many Canadian acid-sensitive ecosystems are still being damaged. Even after all currently planned reductions are in place, some regions may continue to receive excessive acid deposition post-2000. This fact points to the need for renewed and continuing efforts to fully resolve Canada's acid rain problem.



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ANNUAL REPORT ON THE FEDERAL-PROVINCIAL AGREEMENTS FOR THE EASTERN CANADA ACID RAIN PROGRAM

1995



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Annual Report on the Federal-Provincial Agreements for the Eastern Canada Acid Rain Program 1995

Introduction

This annual report on the Eastern Canada Acid Rain Program compares 1995 emissions of sulphur dioxide in the seven easternmost provinces to the emission targets in the program. It does not describe the actions taken by the provinces and industry to achieve those targets -- such as switching fuel, installing scrubbers, building acid plants, and changing industrial processes -- since these actions have already been described in detail in previous reports.

The objective of the Eastern Canada Acid Rain Control Program is to cap sulphur dioxide (SO₂) emissions in eastern Canada at 2,300 kilotonnes for the period 1994 to 2000, which translates into a 40 percent reduction from 1980 actual levels. All the eastern provinces met their emissions targets in 1994, the deadline year.

The Eastern Canada Acid Rain Program, coupled with the U.S. Acid Rain Program which also calls for a 40 percent reduction in SO₂ emissions, is intended to protect moderately sensitive ecosystems from acid deposition.

1995 Emissions

In 1995, the eastern provinces continued to remain well under the 2,300 kilotonne cap, with emissions of 1,794 kilotonnes of SO₂ (or 22% under the cap). Every province met its target, except Newfoundland, which is taking steps to reduce emissions at the Come By Chance refinery. The top three provincial emitters were Ontario, Quebec, and Manitoba; they were under their limits by 24, 19, and 33 percent respectively. New Brunswick, a smaller emitter by comparison, was 36 percent below its limit.

Smelters accounted for 51 percent of SO₂ emissions in eastern Canada in 1995, and fossil fuelled-power plants accounted for another 16 percent. The recent emission rates and provincial targets are shown in Table 1, while Table 2 provides emissions data for the major sources.

Remaining concerns

Despite the success of the Eastern Canada Acid Rain Program, many ecosystems are still being damaged. Lakes and streams in some areas continue to acidify. There are two main reasons for this finding. One is that the U.S. Acid Rain Program will not be fully implemented until 2010; the other is that many areas are so acid-sensitive that a 40 percent reduction in SO₂ emissions is not great enough to protect them from acidification. Climate change may also be having an effect, as well as the deposition of acidifying nitrogen species.

In addition to this ongoing environmental damage, there is a growing concern about the health effects of inhalable particles. This class of pollutants consists of a number of different chemical species, with sulphate particles being one of the main ones. Sulphate particles are formed from SO₂, the main culprit in acid rain. Although scientists do not understand precisely how these tiny airborne particles affect human health, recent studies have shown that they are associated with increased hospital admissions, respiratory diseases such as bronchitis, asthma, and emphysema, and premature mortality.

The U.S. Environmental Protection Agency has recently tried to quantify the human health benefits of reducing sulphate particles. Its study showed that the U.S. Acid Rain Program alone is expected to yield human health benefits to Ontario and Quebec in the order of US\$955 million (M) a year by 2010, or more than one billion in Canadian dollars. This number is based not only on the real costs of illness -- hospital admissions, doctor visits, medication, lost wages -- but also on the estimated monetary value of nonfinancial concerns, such as pain and discomfort. Hence there are many sources of uncertainty and potential error in the health benefits, e.g., the EPA study gave a range of annual health benefits for Ontario and Quebec, from US\$290M to US\$1,868M, with US\$955M as the mean estimate.

Furthermore, fine particulate matter also absorbs and scatters light, thus reducing visibility. Impaired visibility is a safety issue for airport traffic control, and an esthetic issue for tourists and local citizens.

Next Steps

Some of these environmental, health, and visibility effects will be alleviated when the U.S. Acid Rain Program is fully implemented in 2010; however, a large area of Canada is still expected to receive harmful levels of acid deposition.

As a result, the federal and provincial governments are working with stakeholders to develop a new National Strategy on Acidifying Emissions for post-2000 to protect acid-sensitive areas, human health, and visibility in Canada. The Strategy is expected to be completed in 1997, to take effect when the Eastern Canada Acid Rain Program expires in the year 2000.

TOTAL SO₂ EMISSIONS BY PROVINCES (KILOTONNES)¹

	1980	1990	1994	1995	1994
	Actual				Limits ³
MANITOBA					
Primary Metals	463	500	388	358	—
Other	21	16	9	9	—
Total	484	516	397	367	550
ONTARIO					
Primary Metals	1090	729	250	325	490
Power Generation	396	195	106	72	175
Other	272	268	262	275	—
Total	1758	1192	618	672	885
QUEBEC					
Primary Metals	641	189	199	217	—
Other	457	202	183	189	—
Total	1098	391	382	406	500
NEW BRUNSWICK					
Primary Metals	15	6	14	13	—
Power Generation	123	141	90	67	123
Other	80	34	30	31	—
Total	218	181	134	111	175
NOVA SCOTIA					
Power Generation	125	143	133	134	145
Other	68	35	40	38	—
Total	193	178	173	172	189
NEWFOUNDLAND					
Power Generation	18	21	8	15	—
Other	38	36	37	47	—
Total	56	57	45	62	45
PRINCE EDWARD ISLAND					
Total	5	3	4	4	5
EASTERN CANADA TOTAL					
Primary Metals	2209	1424	851	913	—
Power Generation	662	500	337	288	—
Other	941	594	565	593	—
Total ²	3812	2518	1753	1794	2349 ²

1. Data for 1990 to 1995 are taken from annual reports by the provinces on their SO₂ control programs. The emissions levels represent the best estimate available at the time of writing the report. Note that even historic year estimates may be revised as better inventory data are made available.
2. The 1994 Eastern Canada Program target is 2,300 kilotonnes. The total of provincial objectives is currently being renegotiated from 2,349 kilotonnes to 2,300 kilotonnes. Renegotiated federal-provincial agreements are in place with Quebec, New Brunswick and Nova Scotia.
3. The revised emission limit reflects a renegotiated federal-provincial agreement.

TABLE:2

MINERAL EXTRACTION AND SMELTING: MAJOR SO₂ SOURCES (KILOTONNES)

	1980	1990	1994	1995	1994
	Actual				Limits
<u>MANITOBA</u>					
INCO (THOMPSON)	215	247	194	195	220
HBMS (FLIN FLON)	248	253	194	162	220
<u>ONTARIO</u>					
INCO (Copper Cliff)	812	617	162	236	265
FALCONBRIDGE (Sudbury)	123	70	54	45	100
ALGOMA (Wawa, Iron Ore)	155	42	34	44	125
<u>QUEBEC</u>					
NORANDA (Horne)	552	146	156	174	272
NORANDA (Murdochville)	91	43	43	43	65
<u>NEW BRUNSWICK</u>					
NORANDA (Belledune)	15	6	14	13	---

ELECTRIC POWER GENERATION: MAJOR SO₂ SOURCES (KILOTONNES)

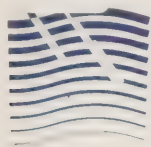
	1980	1990	1994	1995	1994
	Actual				Limits
ONTARIO HYDRO	396	195	106	72	175
NEW BRUNSWICK POWER	123	141	90	67	123
NOVA SCOTIA POWER	125	143	133	134	145

Information

For more information on the Eastern Canada Acid Rain Program, contact the Inquiry Centre at (819) 997-2800 for copies of previous reports.

For more information on the National Strategy on Acidifying Emissions, contact Kathleen Hedley, Acid Rain Program, Environment Canada at (819) 953-4680.

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1997 Annual Report on the Federal-Provincial Agreements for the Eastern Canada Acid Rain Program



Issued by Environment Canada

July 1998

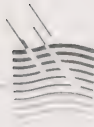
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1997 Annual Report on the Federal-Provincial Agreements for the Eastern Canada Acid Rain Program

*Issued by Environment Canada
July 1998*

Introduction

This report presents a snap shot of 1997 emissions of sulphur dioxide (SO₂) and compares them to our domestic commitments in the Eastern Canada Acid Rain Program. Although nitrogen oxides also contribute to acidification, SO₂ has been the main target for reductions to date.

The report does not describe the actions taken by the provinces and industry to reduce SO₂ emissions since they have been described in previous reports (in particular the *1994 Annual Report on the Federal-Provincial Agreements for the Eastern Canada Acid Rain Program*). Nor does the report include the latest scientific findings on acidifying emissions since they have been recently published in the *1997 Canadian Acid Rain Assessment*.

The eastern Canada cap

The Eastern Canada Acid Rain Program established a cap on SO₂ emissions in the seven easternmost provinces of 2.3 million tonnes, for a 40% reduction from actual 1980 levels. The Program called for the cap to be met by 1994. This cap is also enshrined, and extended to the year 2000, in the Canada-U.S. Air Quality Agreement.

To meet this regional cap on schedule, the seven eastern provinces “divided up the pie” into individual slices — or provincial caps — that they agreed to meet by 1994. Each provincial cap was enshrined in a bilateral agreement between each respective province and the federal government. Some of the agreements expired at the end of 1994 (Manitoba, Newfoundland and Prince Edward Island), while others were re-negotiated in 1992-1993 and extended until the end of 1999 (Nova Scotia, New Brunswick, and Quebec). The Ontario agreement extends its 1994 commitment in perpetuity.

The goal of the Eastern Canada Acid Rain Program was to protect moderately sensitive ecosystems from acid rain. Achieving this goal, however, also depends upon the U.S. Acid Rain Program which calls for a 40% reduction in national SO₂ emissions by 2010.

Progress

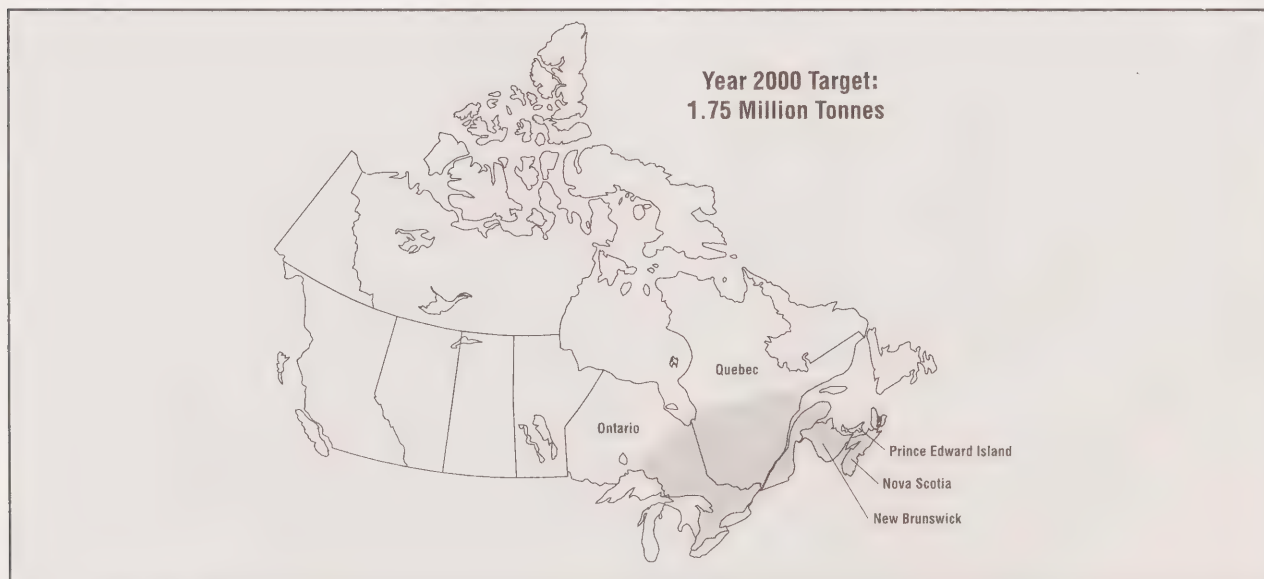
In 1997, the seven eastern provinces collectively emitted 1.75 million tonnes of SO₂, 24% below the 2.3 million tonne cap, and a 54% reduction from 1980 levels. Smelters made up 49% of the eastern Canada total, while power generation made up 21%. The remaining 30% came from petroleum refining, aluminum production, the pulp and paper industry, cement and concrete manufacturing, and transportation.

The provinces with caps still in effect — Ontario, Quebec, New Brunswick, and Nova Scotia — all had SO₂ emissions well below their respective caps, as did Manitoba. (Newfoundland and P.E.I. both met their 1994 caps in 1994, as required.)

Table I shows SO₂ emissions by province between 1980-1997, while Table 2 shows SO₂ emissions from the large point sources in eastern Canada. As Table 1 indicates, 1997 SO₂ emission levels were largely unchanged from 1996, with the exception of Ontario Hydro and New Brunswick Power. Both utilities had to generate more power from their fossil-fuelled power plants to compensate for decreased power production at their nuclear plants (due to lay-ups and maintenance), hence the increase in emissions.

Second Sulphur Protocol

In 1997, Canada ratified the United Nations Economic Commission for Europe “Second Sulphur Protocol,” which established a new regional cap of 1.75 million tonnes of SO₂ for south-eastern Canada by 2000. The new cap applies to a region called the SOMA (Sulphur Oxide Management Area) that includes the major sources in Ontario, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island. In 1997, SO₂ emissions in the SOMA were roughly 1.3 million tonnes, well under its cap.



Next Steps

Despite this good progress, acid rain remains a stubborn problem in eastern Canada. In fact, even with full implementation of the U.S. Acid Rain Program in 2010, an area approximately the size of France and the United Kingdom combined (791,000 square kilometres) is still expected to receive acid deposition in excess of critical loads or threshold levels. Scientists predict that SO₂ emission reductions of up to 75% in targeted regions of eastern Canada and the U.S. are required to protect the environment from acid rain. More details on the scope and nature of the problem can be found in the report *Towards A National Acid Rain Strategy*, published by the multi-stakeholder Acidifying Emissions Task Group in October 1997.

Furthermore, after 1999 the 2.3 million tonne cap for eastern Canada will no longer exist.

As a result, federal and provincial governments are now finalizing *The Canada-Wide Acid Rain Strategy for Post-2000* to provide the framework for further SO₂-reduction-commitments in eastern Canada. *The Strategy* is expected to be submitted to Energy and Environment Ministers for approval in the fall of 1998.

The federal government is also actively seeking further SO₂ emission reductions in the U.S. beyond their current commitments. These emission reductions south of the border are essential for protecting sensitive ecosystems in eastern Canada. Simultaneously, the U.S. Environmental Protection Agency is also considering a further 50% SO₂ emission reduction as one of the ways for achieving the new U.S. National Ambient Air Quality Standard for fine particulate matter. (SO₂ can transform in the air into tiny sulphate particles that penetrate deep into the lungs, harming human health.)

Table 1: Total SO₂ emissions by province (kilotonnes)¹

	1980	1990	1994	1995	1996	1997	Limits	
							level	time-frame
Manitoba								
Primary Metals	463	500	388	358	379	389		1994 only
Other	21	16	9	7	9	9		
Total	484	516	397	365	388	398	550	
Ontario								
Primary Metals	1,090	729	250	325	329	291		not set expiry
Power Generation	396	195	106	72	85	124		
Other	272	242	262	223	253	229		
Total	1,758	1,166	618	620	667	644	885	
Quebec								
Primary Metals	641	189	199	215	189	170		until end of 1999
Other	457	202	183	163	177	166		
Total	1,098	391	382	378	366	336	500	
New Brunswick								
Primary Metals	15	6	14	13	13	13		until end of 1999
Power Generation	123	141	90	67	52	85		
Other	80	34	30	35	29	28		
Total	218	181	134	115	94	126	175	
Nova Scotia								
Power Generation	125	143	133	134	130	138		until end of 1999
Other	68	35	40	38	40	37		
Total	193	178	173	172	170	175	189	
Newfoundland								
Power Generation	18	21	8	15	14	16		1994 only
Other	38	41	36	47	55	54		
Total	56	62	44	62	69	70	45	
Prince Edward Island	5	3	4	4	4	5	5	1994 only
Eastern Canada								
Primary Metals	2,209	1,424	851	911	910	863		2,349 ²
Power Generation	662	500	337	288	281	363		
Other	941	573	564	517	567	528		
Total²	3,812	2,497	1,752	1,716	1,758	1,754		

1. Emissions data are taken from provincial reports and represent the best estimate available at the time of writing. Historic year estimates may be revised as better inventory data become available.
2. The Eastern Canada Program target was 2,300 kilotonnes by 1994. The total of provincial objectives is currently being re-negotiated from 2,349 kt to 2,300 kt. Re-negotiated federal-provincial agreements are in place with Quebec, New Brunswick and Nova Scotia, extending the time-frame from 1994 to the end of 1999, and reducing the provincial SO₂ caps.

Table 2: Major SO₂ sources (kilotonnes)**(a) Mineral extraction and smelting in eastern Canada**

	1980	1990	1994	1995	1996	1997	1994 Limit
Manitoba							
INCO (Thompson)	215	247	194	195	195	210	220
HBMS (Flin Flon)	248	253	194	162	184	179	220
Ontario							
INCO (Copper Cliff)	812	617	162	236	236	200	265
FALCONBRIDGE (Sudbury)	123	70	54	45	53	54	100
ALGOMA (Wawa, Iron Ore)	155	42	34	44	40	37	125
Quebec							
NORANDA (Horne)	552	146	156	172	150	136	272
NORANDA (Murdochville)	91	43	43	43	39	54	65
New Brunswick							
NORANDA (Belledune)	15	6	14	14	13	13	—

(b) Electric power generation in eastern Canada (kilotonnes)

	1980	1990	1994	1995	1996	1997	1994 Limit
ONTARIO HYDRO	396	195	106	72	85	124	175
NEW BRUNSWICK POWER	123	141	90	67	52	85	123
NOVA SCOTIA POWER	125	143	133	134	130	138	145

Information

For additional copies of this report and/or other reports cited here, please contact Environment Canada's Inquiry Centre at 1-800-668-6767 or (819) 997-2800. Many of the reports are on Environment Canada's web site: <http://www.doe.ca/pdb/doe.html>.

For more information on the Acid Rain Program, please contact Peggy Hallward, Environment Canada at (819) 997-6819.

Également disponible en français.

Tableau 2 : Principales sources de SO₂ (kilotonnes)

a) Extraction minière et fusion dans l'est du Canada

	1980	1990	1994	1995	1996	1997	Limite de 1994
Manitoba							
INCO (Thompson)	215	247	194	195	195	210	220
HBMS (Flin Flon)	248	253	194	162	184	179	220
Ontario							
INCO (Copper Cliff)	812	617	162	236	236	200	265
FALCONBRIDGE (Sudbury)	123	70	54	45	53	54	100
ALGOMA (Wawa, Iron Ore)	155	42	34	44	40	37	125
Québec							
NORANDA (Horne)	552	146	156	172	150	136	272
NORANDA (Murdochville)	91	43	43	43	39	34	65
Nouveau-Brunswick							
NORANDA (Belledune)	15	6	14	14	13	13	—

(b) Production d'électricité dans l'est du Canada (kilotonnes)

	1980	1990	1994	1995	1996	1997	Limite de 1994
ONTARIO HYDRO	396	195	106	72	85	124	175
ÉNERGIE NOUVEAU-BRUNSWICK	123	141	90	67	52	85	123
NOVA SCOTIA POWER	125	143	133	134	130	138	145

Renseignements

Pour obtenir d'autres exemplaires de ce rapport et (ou) d'autres rapports qui y sont mentionnés, veuillez vous adresser à l'Informathèque au 1 800 668-6767 ou (819) 997-2800. Vous trouverez également plusieurs de ces rapports sur le site Web d'Environnement Canada : http://www.doc.ca/pdb/doc_fr.html.

Pour en savoir plus sur le Programme de lutte contre les pluies acides, veuillez vous adresser à Peggy Hallward, Environnement Canada, au (819) 997-6819.

Also available in English.

Tableau 1 : Total des émissions de SO₂ par province (kilotonnes)¹

Limites	1980	1990	1994	1995	1996	1997	niveau	échancier
Manitoba	Métaux primaires	463	500	388	358	379	389	1994
	Total	484	516	397	365	388	398	seulement
Ontario	Métaux primaires	1 090	729	250	325	329	291	aucune
	Production d'électricité	396	195	106	72	85	124	fixée
Québec	Métaux primaires	641	189	199	215	189	170	avant la
	Total	1 098	391	382	378	366	336	fin de 1999
Nouveau-Brunswick	Métaux primaires	15	6	14	13	13	13	avant la
	Production d'électricité	123	141	90	67	52	85	fin de 1999
Nouvelle-Écosse	Production d'électricité	125	143	133	134	130	138	avant la
	Total	193	178	173	172	170	175	fin de 1999
Terre-Neuve	Production d'électricité	18	21	8	15	14	16	1994
	Total	56	62	44	62	69	70	seulement
Île-du-Prince-Édouard	Production d'électricité	18	21	8	15	14	16	1994
	Total	56	62	44	62	69	70	seulement
Est du Canada	Métaux primaires	2 209	1 424	851	911	910	863	1994
	Production d'électricité	662	500	337	288	281	363	fin de 1999
Total	Métaux primaires	3 812	2 497	1 752	1 716	1 758	1 754	1994
	Total	941	573	564	517	567	528	fin de 1999
2 349 ²								

1. Les données sur les émissions sont tirées de rapports provinciaux et représentent les meilleures estimations disponibles au moment de la rédaction de ce rapport. Signalons que les estimations des années antérieures pourraient être révisées si de meilleures données deviennent disponibles.
2. L'objectif du programme pour l'est du Canada était de 2 300 kilotonnes avant 1994. Le total des objectifs provinciaux fait actuellement l'objet d'une négociation et devrait passer de 2 349 à 2 300 kilotonnes. Le fédéral a déjà renoncé des centres bilatérales avec le Québec, le Nouveau-Brunswick et la Nouvelle-Écosse, prolongeant l'échéancier de 1994 jusqu'à la fin de 1999 et réduisant les limites provinciales de SO₂.

Prochaines étapes

En dépit de progrès incontestables, les pluies acides demeurent un problème tenace dans l'est du Canada. De fait, malgré l'application intégrale du Programme américain sur les pluies acides en 2010, un territoire équivalant à la superficie de la France et du Royaume-Uni confondus (791 000 km²) devrait continuer de recevoir plus de dépôts acides que les charges ou les seuils critiques établis. Les scientifiques estiment qu'il faudrait réduire les émissions de SO₂ de 75 % dans les régions ciblées de l'est du Canada et des États-Unis pour protéger l'environnement contre les pluies acides. On trouvera plus de précisions sur la portée et la nature du problème dans le rapport intitulé *Vers une stratégie nationale sur les pluies acides*, publié en octobre 1997 par le groupe de travail sur les émissions acidifiantes qui compte des intervenants multiples.

De plus, à la fin de 1999, la limite de 2,3 millions de tonnes pour l'est du Canada n'existera plus.

Le gouvernement fédéral cherche également à inciter les États-Unis à réduire davantage leurs émissions de SO₂ au-delà de leurs engagements actuels. Ces réductions au sud de la frontière sont essentielles pour la protection des écosystèmes sensibles de l'est du Canada. Parallèlement, l'Environnemental Protection Agency des États-Unis envisage aussi une réduction supplémentaire de 50 % des émissions de SO₂ comme l'un des moyens de se conformer à la nouvelle norme nationale sur la qualité de l'air ambiant pour les particules fines. (Le SO₂ peut se transformer dans l'air en de minuscules particules soufrées qui pénètrent dans les poumons, mettant ainsi en danger la santé humaine).

C'est pourquoi les gouvernements fédéral et provinciaux mettent la dernière touche à la *Stratégie pancanadienne sur les émissions acidifiantes pour après l'an 2000* afin de fournir un cadre en vue de la prise d'engagements supplémentaires en matière de réduction des émissions de SO₂ dans l'est du Canada. Cette stratégie devrait être soumise à l'approbation des ministres de l'énergie et de l'environnement à l'automne 1998.



Progrès

1994 (Manitoba, Terre-Neuve et Île-du-Prince-Édouard), tandis que d'autres ont été renégociées en 1992-1993 et prorogées jusqu'à la fin de 1999 (Nouvelle-Écosse, Nouveau-Brunswick et Québec). L'entente conclue avec l'Ontario reconduit son engagement de 1994 pour une durée illimitée.

Le Programme de lutte contre les pluies acides dans l'est du Canada a pour but de protéger les écosystèmes modérément sensibles contre les pluies acides. Cependant, l'atteinte de cet objectif dépend aussi du Programme américain sur les pluies acides qui prévoit lui aussi une diminution de 40 % des émissions nationales de SO_2 d'ici l'an 2010.

Deuxième protocole sur le soufre

En 1997, le Canada a ratifié le deuxième protocole sur le soufre de la Commission économique des Nations Unies pour l'Europe, qui fixe une nouvelle limite régionale de 1,75 million de tonnes de SO_2 pour le sud-est du Canada dès l'an 2000. Cette nouvelle limite s'applique à une région connue sous le nom de zone de gestion des oxydes de soufre (ZGOS), qui englobe les principales sources de l'Ontario, du Québec, du Nouveau-Brunswick, de la Nouvelle-Écosse et de l'Île-du-Prince-Édouard. En 1997, les émissions de SO_2 dans la ZGOS se sont chiffrées à près de 1,3 million de tonnes, ce qui est nettement inférieur à la limite fixée.

En 1997, les sept provinces de l'est confondues ont rejeté 1,75 million de tonnes de SO_2 , soit 24 % de moins que la limite de 2,3 millions de tonnes, et une baisse de 54 % par rapport aux niveaux de 1980. Les fondertes sont responsables de 49 % des émissions totales dans l'est du Canada, tandis que 21 % sont imputables aux centrales électriques. Le reste, soit 30 %, est produit par les raffineries de pétrole, les aluminiumeries, l'industrie des pâtes et papiers, la fabrication de ciment et de béton et les transports.

Les provinces qui sont toujours assujetties à une limite (l'Ontario, le Québec, le Nouveau-Brunswick et la Nouvelle-Écosse) ont toutes enregistré des émissions de SO_2 nettement inférieures à leurs limites respectives, tout comme le Manitoba, Terre-Neuve et l'Île-du-Prince-Édouard. Elles ont atteint leurs limites de 1994 en 1994, comme prescrit.



Rapport annuel

sur

les ententes fédérales-provinciales

concernant

le Programme de lutte contre les pluies acides dans l'est du

Canada

1997

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Juillet 1998*

Introduction

Le présent rapport compare les quantités de dioxyde de soufre (SO_2) rejetées en 1997 aux engagements pris dans le cadre du Programme de lutte contre les pluies acides dans l'est du Canada. Même si les oxydes d'azote contribuent également à l'acidification, c'est le SO_2 qui a été la principale cible des mesures de réduction jusqu'ici.

Le rapport de 1997 ne décrit pas les mesures prises par les provinces et l'industrie pour réduire les émissions de SO_2 puisque celles-ci l'ont été dans les rapports antérieurs (en particulier dans le Rapport annuel de 1994 sur les ententes fédérales-provinciales concernant le Programme de lutte contre les pluies acides dans l'est du Canada). Par ailleurs, il ne présente pas les derniers résultats scientifiques sur les émissions acidifiantes car ceux-ci ont récemment été publiés dans le Rapport d'évaluation de 1997 sur les émissions acidifiantes.

Limite fixée pour l'est du Canada

Le Programme de lutte contre les pluies acides dans l'est du Canada limite à 2,3 millions de tonnes les émissions de SO_2 dans les sept provinces canadiennes les plus à l'est, ce qui représente une réduction de 40 % par rapport aux niveaux de 1980. Le programme prescrit que la limite devait être atteinte avant 1994. Cette limite, qui est enchaînée dans l'Accord entre le Canada et les États-Unis sur la qualité de l'air, est reportée à l'an 2000.

Pour atteindre cet objectif régional dans les délais impartis, les sept provinces de l'est ont « coupé le gâteau » en tranches individuelles, ou limites provinciales, qu'elles se sont engagées à atteindre avant 1994. Ces limites provinciales ont été enchaînées dans les ententes bilatérales conclues entre chacune des provinces et le gouvernement fédéral. Certaines des ententes ont expiré à la fin de



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